

**DIGITAL COMMUNICATION
(ECEN 3101)**

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) In QPSK the transmission bandwidth required is
 - (a) f_b
 - (b) $2 f_b$
 - (c) $f_b/2$
 - (d) $4 f_b$ where f_b = Bit frequency
- (ii) Granular noise in DM occurs when
 - (a) signal changes rapidly with time
 - (b) signal remains constant with time
 - (c) there is interference from the adjacent channel
 - (d) bandwidth is too large
- (iii) In vestigial spectrum the range of roll off factor is
 - (a) $0 < r < 1$
 - (b) $1 < r < 0$
 - (c) $0 < r < \infty$
 - (d) none of these
- (iv) Which of the following is the drawback for cordless telephones?
 - (a) Wireless technology
 - (b) Limited coverage area
 - (c) Mobile
 - (d) Security.
- (v) Which encoding method uses alternating positive and negative values for 1s?
 - (a) NRZ
 - (b) RZ
 - (c) Manchester
 - (d) AMI.

- (vi) An analog signal has significant spectral components from 1 kHz to 5 kHz. What is the Nyquist sampling rate for this signal?
 - (a) 5 k samples/s
 - (b) 8 k samples/s
 - (c) 10 k samples/s
 - (d) 4 k samples/s
- (vii) The output SNR of a matched filter, fed at its input by a rectangular pulse of amplitude A and duration T is given as (τ noise power spectral density)
 - (a) $2A^2 T / \tau$
 - (b) AT
 - (c) A/T
 - (d) A/τ
- (viii) The bit rate for the digital communication system is 36 Mbps. For 16-PSK modulation scheme, what is the baud rate
 - (a) 18 Mbps
 - (b) 9 Mbps
 - (c) 72 Mbps
 - (d) 36 Mbps
- (ix) The sequence of operations in which PCM is done
 - (a) sampling, quantizing, encoding
 - (b) quantizing, encoding, sampling
 - (c) quantizing, sampling, encoding
 - (d) none of the above
- (x) An 16-PSK modulated signal has the bit rate 4000bps; baud rate is (symbols / sec)
 - (a) 2000
 - (b) 4000
 - (c) 8000
 - (d) 1000.

Fill in the blanks with the correct word

- (xi) In the PCM system, SNR depends on _____.
- (xii) Eye Pattern is used to study _____.
- (xiii) In Delta modulation slope overload distortion can be minimized by _____ the step size.
- (xiv) BW of MSK is _____ than that of QPSK.
- (xv) _____ Division multiplexing requires guard band in frequency domain.

Group - B

2. (a) Discuss the operation of Sample & Hold circuit with proper diagram.

[[C01]&(C02)(Understand/LOCQ)]

- (b) How does the step size of the quantizer decide quantization noise? [[CO4](Analyse/IOCQ)]
- (c) A 6-bit PCM system is uniformly quantized with a bit rate of 4.8 kbps. Determine the signal-to-quantization noise ratio that would result when its input is a sine wave with peak amplitude equal to 10 V. [[CO2](Apply/IOCQ)]
4 + 2 + 6 = 12
3. (a) Explain the aperture effect in sampler circuit and suggest possible measures to eliminate it? [[CO1&CO2](Analyse/IOCQ)]
- (b) Elaborate the necessity of companding in the PCM system? [[CO2](Analyse/IOCQ)]
- (c) A television signal having a B.W of 4.2 MHz is transmitted using a binary PCM system. The number of quantization levels is 512. Determine (i) code word length (ii) transmission B.W (iii) Final bit rate (iv) output signal to quantization noise ratio. [[CO2](Apply/IOCQ)]
(2 + 2) + 4 + 4 = 12

Group - C

4. (a) Eye diagram helps us to measure the amount of ISI present in a channel : Justify. [[CO3](Analyse/HOCQ)]
- (b) Explain Nyquist 1st criterion for zero ISI to control intersymbol interference at decision making instants of the sampled signal. [[CO3](Analyse/IOCQ)]
- (c) Data rate of 12 kbps is to be transmitted over a channel of bandwidth 8 kHz by using a raised cosine pulse. Determine the roll off factor. [[CO3](Apply/IOCQ)]
4 + 4 + 4 = 12
5. (a) Identify the differences between line coding and source coding [[CO3](Analyse/IOCQ)]
- (b) Draw and explain the operation of a regenerative repeater. [[CO3](Understand/LOCQ)]
- (c) To transmit a bit sequence of 011001011010110, draw the resulting waveform using (i) Unipolar NRZ and RZ (ii) Polar-NRZ and RZ (iii) Bipolar NRZ or AMI (iv) Manchester Coding. [[CO3](Apply/IOCQ)]
3 + 3 + 6 = 12

Group - D

6. (a) Mention the advantages of QPSK over QPSK. [[CO4](Understand/LOCQ)]
- (b) Why is the non-coherent detection of BPSK not possible? What variant of PSK, we may use to avoid coherent detection? [[CO4](Analyse/IOCQ)]
- (c) For such modulation scheme, generate the encoding sequences for the data bit stream 10001101. [[CO4](Apply/IOCQ)]
4 + 4 + 4 = 12
7. (a) Explain the operation of the ASK modulation system with a suitable diagram. [[CO4](Analyse/IOCQ)]
- (b) Define bit rate and baud rate. [[CO4](Remember/LOCQ)]

- (c) The bit rate for the digital system is 34 Mbps. For the QPSK modulation scheme, calculate the baud rate.

[[C04](Apply/IOCQ)]

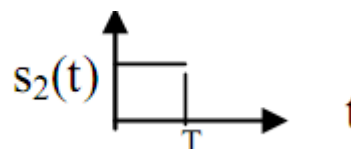
$$4 + 4 + 4 = 12$$

Group - E

8. (a) Under which condition a correlation receiver acts as a matched filter?
 (b) What is the significance of the term 'Matched' in matched-filter?
 (c) Draw the impulse response of the matched filter with the waveform given below as its input.

[[C05](Analyse/IOCQ)]

[[C05](Understand/LOCQ)]



[[C05](Apply/IOCQ)]

$$4 + 2 + 6 = 12$$

9. (a) Identify the most efficient digital modulation scheme based on their BER & transmission BW requirement.
 (b) How the decision about the received signal is made from the signal space diagram in the BPSK modulation system?

[[C05](Analyse/HOCQ)]

[[C05](Analyse/IOCQ)]

$$6 + 6 = 12$$

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	17.70	71.88	10.42